CALIFORNIA DIVISION OF MINES AND GEOLOGY
FAULT EVALUATION REPORT FER-220

Faults in the Big Valley area, Modoc and Lassen Counties

by
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INTRODUCTION

North and northwest-trending normal faults cross Big Valley in southwestern Modoc and northwestern Lassen Counties. Many of these faults follow prominent escarpments in Tertiary volcanic rocks. Some may cross the valley, largely covered by Plio-Pleistocene and Quaternary alluvium and lake beds. These faults are similar in orientation and sense of displacement to the nearby, active, Hat Creek, McArthur and Pitville faults (Wills, 1990). Because these faults are shown to be Quaternary by Jennings (1975), lie within the current Modoc Plateau study area and pass close to the towns of Bieber and Adin, they are evaluated here for possible zoning under the Alquist-Priolo Special Studies Zones Act (Hart, 1988).

SUMMARY OF AVAILABLE DATA

Northwest-trending faults cutting the volcanic bedrock around the edges of Big Valley were first mapped by Gay and Aune (1958). They generally show short (up to 15 km long) discontinuous faults in Tertiary and Pleistocene volcanic rocks (Figure 1). Two of these are shown to project for short distances into younger Quaternary alluvial deposits. A more extensive study of the geology of the area, emphasizing the availability of groundwater, was conducted by the California Department of Water Resources (DWR, 1963).

Faults mapped by DWR are shown on Figure 2. These faults are more common, longer and more continuous than those mapped by Gay and Aune (1958). The map by DWR shows faults offsetting Tertiary and Pleistocene units and concealed beneath Plio-Pleistocene Bieber Formation and younger alluvial units (shown as "Recent"). Short portions of several faults at the margins of the valley are mapped as juxtaposing volcanic bedrock with Recent alluvial deposits or Bieber Formation. In every case where a fault is along the contact of Recent alluvium or Bieber Formation, a projection of the same fault is shown to be concealed beneath alluvium or Bieber Formation. No faults are shown entirely within either the Bieber Formation or alluvium on

the map by DWR. A cross-section by DWR shows faults in the lower Bieber Formation but none that offset the top of the Bieber Formation or Recent alluvium.

DWR shows faults with up to 2000 ft (600 m) of vertical displacement since Miocene time on a cross-section. These faults were located by a geophysical survey conducted by DWR, although DWR's report does not state what type of geophysical survey was used.

INTERPRETATION OF AERIAL PHOTOGRAPHS

Geomorphic evidence for recent faulting was interpreted from aerial photographs and plotted on 15-minute topographic maps (Figure 2). Aerial photographs of 1:20,000 scale taken by the USDA in 1954 and 1955 were used for the entire area. No field checking of this area was done because of the limited time available for this study and because of the lack of evidence for Holocene faulting on aerial photographs.

Faults mapped by DWR (1963) in the bedrock surrounding Big Valley were generally confirmed as geomorphic features. Most of these are broad, erosionally degraded scarps without any smaller scarps, benches or breaks-in-slope that would indicate late Pleistocene to Holocene movement. Annotations describing the general form of the scarps and geomorphic features indicating fault location are shown on Figure 2. Several faults mapped by DWR appeared to be mislocated slightly or somewhat simplified. Some could not be verified as geomorphic features.

Only one of the faults mapped across Big Valley by DWR could be confirmed by interpretation of aerial photographs. This fault (Locality 1, Figure 2) is expressed at the surface as a broad, vague, tonal lineament in Plio-Pleistocene Bieber Formation. No geomorphic expression was observed on this feature, suggesting it is not a Holocene fault.

Many other tonal lineaments were observed both in the Bieber Formation and in the late Pleistocene to Holocene alluvium (Figure 2). None of these coincide with previously mapped faults. Many could be artificial (roads, trails, drainage ditches, etc.), old stream channels or bedding in the Bieber Formation. These tonal features generally trend N20°W to N40°W and are less than 4 km long. They lack the geomorphic expression that is characteristic of recent faulting. If any of these features in the latest Pleistocene to Holocene alluvium are faults, the tonal features observed may represent fault rupture in latest Pleistocene to Holocene time.

CONCLUSIONS

North- to Northwest-trending normal faults offset Tertiary through Plio-Pleistocene volcanic and sedimentary rocks in the Big Valley area. In the volcanic rocks, broad degraded scarps suggest no recent movements or a very low slip rate. The lack of geomorphic expression in younger sedimentary deposits suggest that these faults have not been active in latest Pleistocene to Holocene time.

RECOMMENDATIONS

The faults of the Big Valley area do not have clear evidence for Holocene activity and are not recommended for zoning under the Alquist-Priolo Special Studies Zones Act.

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Reviewed & approved.
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